Disclosure

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***Title of Disclosure (in English)**

Business method for diagnosing printer problems and "notarizing" prints by evaluating embedded data

Summary

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Inventors with Lotus Notes IDs

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IDT Selection

Select Functional Area

IDT Team:	Attorney/Patent Professional:

Response Due to IP&L :

***Main Idea**

1. Describe your invention, stating the problem solved (if appropriate), and indicating the advantages of using the invention.

When an IBM printer customer has print quality problems, the current way of handling the inquiry is time- and labour-intensive. A call is placed by the customer, which is answered by one or more Customer Engineers (CEs). The CEs run a series of diagnostic routines on the printer, checking for parts that need to be adjusted or replaced. If the problem is not solved through these methods, level 2 support is contacted. If level 2 support cannot assist the CE in finding the problem, print samples may be sent to Product Engineering (PE) and then to development for analysis. Questions that will flow back to the CE include the settings on the engine, the mix life, and other data points. Given the amount of time that may pass between the initial call response and elevation to another department, the original settings on the printer may have been changed or lost. This is an expensive and inefficient way to trouble shoot print quality issues.

This disclosure describes a new business method for streamlining this process. Information about the engine is embedded in a print coming from the engine in such a way that the image can be scanned without destroying the embedded data. This information may be embedded in every print, or just in specific test prints (the relative advantages and disadvantages of both approaches are described below). The print sample with embedded data is obtained by the CE during the initial call. The print sample may be forwarded to each subsequent department addressing the problem, as appropriate, so that the embedded data can be retrieved and analyzed. To assist level 2 in addressing the initial problem, a diagnostic manual for the embedded data may be provided, allowing common print quality issues to be screened and solved immediately. The advantage is that the state of the engine at the time of the problem is not lost, misread, or forgotten; rather, the state is embedded in the print sample. Furthermore, more state information is stored in the engine and AFCCU than is available to the CE for recording, and this "unavailable" data can also be embedded in the test print. The result is a more efficient and faster response to customer print quality issues, leading to reduced cost and improved customer satisfaction.

An additional application of the technology can allow IBM's printers to become "digital notaries". Documents that are printed for legal or secure applications (e.g., legislature, or other government applications) may have a time stamp on the page, which may not be seen and altered by a hostile party. Printer serial number may be required for secure applications to assist in tracking all printed copies of closely-controlled, classified data. Our invention can be extended to embedding in the document the date, time, printer serial number, and other printer settings. This data may be read out by IBM when required to assist with an investigation, to verify the print. This could allow IBM to market this invention to legal and/or government customers as additional features of the product.

2. How does the invention solve the problem or achieve an advantage,(a description of "the invention", including figures inline as appropriate)?

As described herein, there are two basic methods of embedding data, which may be used independently of each other, or in combination. These methods are described in more detail in our other disclosure, "Methods for embedding data in digital prints".

A. The pels themselves may be modified, through the addition or subtraction of single pels near existing pel groupings in the image, for which there is existing technology on the method of embedding so that the perceptual print quality is not affected; or

B. The printer may make selective use of toners with different properties; e.g., a toner with detectable magnetic properties may be used in specific areas, so that the appearance of the print is unchanged, but a magnetic scanner will be able to detect the underlying pattern.

One might ask, what does the embedding of data buy over simply printing out printer parameters on a piece of paper? The answer is this: there are characteristics of the printer components that one might not want the customer to monitor, because the cost of meeting customer satisfaction might increase. For example, a customer printing nothing but statements, with only moderate demands on print quality, might be left running a particular component, like drum and hotroll, much longer than a customer with more demanding applications. The first customer, being able to monitor the age of the drum, would be more likely to demand a replacement drum before one is really needed for maintaining print quality.

Whether the embedded data is placed in every page or just in particular pages is dependent on the customer application. The following cases describe two possible configurations:

1. A customer printing barcodes or other jobs that need to be pixel-accurate for scanning could not have embedded data in the barcodes, for risk of ruining the information already embedded in the barcodes. For customers such as this, the data would only be embedded in a particular test print, or the toner characteristic embedding method (#B above) could be used in the barcodes.

2. For other customers, e.g., those printing text and images, data could be embedded in each print without appreciably affecting perceptual signal-to-noise ratio (PSNR, an unofficial industry standard for measuring the noisiness of an image). The advantage of this approach is that any problem print for the customer will contain the printer configuration information, even if the problem is intermittent. Option #1 above might have a problem capturing intermittent problems.

High-density scanners (e.g., 1200 dpi native resolution) are available, which would be used to scan the 600 dpi data for analysis. Since the pel modification method (#A above) is performed in software, the technological capability already exists to implement this method in existing IBM printer products. A prototype of #A, embedding known data in a gray area or IBM logo added to the title page of a print, is intended for 1Q'01. Method #B would require some development to implement, although such technology is not out of reach of IBM's InfoPrint 4000 products, with some modifications.

Considerations for data embedding algorithms include the following:

1. The data must be robust to printer configuration, including contrast, PQE, and mix age. This can be accomplished through self-calibrating data embedding, which is existing technology.

2. The data must be robust to typical mild-to-moderate print quality errors, including slight beam alignment errors, over toning, mild streaking or spotting, and small, sparse voids.

The legal and government applications (e.g., "digital notary") stem from scenarios like the following:

1. A document, generated today, is stamped by a hostile party as if it were generated 3 years ago, where the date of generation is used in a legal dispute (e.g., patent case). The embedded data can resolve this discrepancy quickly by revealing the true print date.

2. A hostile agent is found with classified launch codes in his possession. Embedded data reveals the exact printer (through S/N) and date at which the codes were printed, assisting the controlling agency in their investigation of the source of the "leak".

3. The digital notary could be used in the generation of lottery tickets, currency, election ballots, and other official paperwork, either in combination with current "special paper" technologies (such as those used for US currency), or in place of expensive colour and page costs (such as with lottery tickets). Since the data is difficult or impossible to detect in the print to a hostile party who is not familiar with the digital signature, it is harder to falsify than a barcode.

IBM could market to such customers a capability to identify this embedded information in prints. The identification could be performed by software delivered to government customers (who would likely be hostile to the idea of not being able to perform the identification themselves on classified prints).

Finally, once the capability for embedding data into the print is included in the printer, this capability can be extended to supporting printer-based watermarking of PoD jobs. Watermarking – the embedding of data to identify the owner or initiator of an image, or to detect tampering – is well known, but these inventors are not aware of any application where the watermark is applied at the printer. The advantage of printer-based watermarking is that any job that comes off the printer is automatically watermarked, saving the customer the time and complexity of watermarking each job before printing.

3. If the same advantage or problem has been identified by others (inside/outside IBM), how have those others solved it and does your solution differ and why is it better?

The inventors are not aware of any prior art in the area of this business method. Methods for data embedding to withstand subsequent scanning are a current area of much research; e.g., IBM Watson research works in this area. It is anticipated that current methods for data embedding can be used for this invention.